

SMART DIGITAL PORTS OF THE FUTURE 2024

SMART DIGITAL PORTS OF THE FUTURE EUROPE

24 - 25 SEPTEMBER 2024 ROTTERDAM, THE NETHERLANDS

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FROM THE EDITOR

Welcome to the latest issue of our maritime journal, where we delve into current trends and pioneering developments in the industry! We are thrilled to present this edition as we celebrate the eighth instalment of Smart Digital Ports of the Future (SDP 2024). Once again, we're in Rotterdam to explore the cutting-edge technologies that are transforming ports into streamlined, secure, and sustainable hubs.

In this special issue, we're pleased to share insights from our key sponsors and speakers. Verizon starts us off with an exploration of how private 5G networks are revolutionising port operations. Their piece highlights how these networks, central to "Port 4.0," enable real-time data transmission, low-latency automation, and enhanced security, paving the way for smoother logistics and greater operational efficiency.

Connectivity remains a crucial theme in Panasonic's piece, exploring the role of Internet of Things (IoT) technologies alongside their rugged mobile devices like the Panasonic TOUGHBOOK. Their analysis emphasizes how these advancements enhance safety, improve asset tracking, and support sustainability efforts.

Data quality and management take centre stage in this edition, with several articles underscoring their importance in the digital transformation of port operations. Awake.Al's research on just-intime scheduling reveals how sophisticated data analysis can reduce vessel waiting times, fuel consumption, and emissions, all crucial for boosting port efficiency.

Kevin Martin from One Digital Nation explores the critical need for Data Quality Automation. As ports increasingly adopt artificial intelligence (AI) and IoT technologies, accurate data management is vital for maintaining efficiency and regulatory compliance. High-quality data, Martin argues, is essential for informed decision-making and resilience against future challenges.

We also delve into the expanding role of smart port solutions, especially Port Community Systems (PCS). Umesh Kurlekar from Kale Logistics offers insights into how PCS platforms centralise data, streamline processes, and improve stakeholder communication. By integrating AI, IoT, and blockchain, PCS are reducing manual errors, optimising workflows, and supporting sustainability by cutting resource wastage.

Hans Rook and Nico de Cauwer from IPCSA further explore the impact of PCS on global trade. Their article highlights how secure, real-time data exchange enhances transparency and operational efficiency, while also reducing fuel consumption and emissions, showcasing the dual benefits of digital innovation.

Emerging technologies like Digital Twins are also featured, with Jorge Melero Corell and Gonzalo Sandiás Corbillón from TIC4.0 discussing how these virtual models of physical assets are revolutionising port operations. Digital Twins improve planning, predictive maintenance, and performance optimisation through Big Data integration.

Returning once more to our journal, AllRead discusses how Optical Character Recognition (OCR) is enhancing port security and efficiency. By automating access control and monitoring, OCR helps manage the flow of people, vehicles, and goods while ensuring compliance with the International Ship and Port Facility Security Code.

We're also delighted to welcome back Que Tran, Vice President of Technology at DP World Europe. His piece emphasises the importance of aligning technological innovations with business Margherita Bruno, Editor



needs to drive efficiency, sustainability, and growth. Digitalisation offers great benefits but requires careful planning and collaboration to effectively transform supply chains.

As digitalisation and decarbonisation continue to intersect, our next contributors examine how ports are working to reduce emissions and enhance energy efficiency. A joint study by Royal HaskoningDHV and Portwise explores optimising shore power systems through berth simulations, demonstrating how reconfiguring zones can lead to significant cost and energy savings.

Michaela O'Donohoe from GE Vernova provides an in-depth look at alternative power systems, including electric ship architectures and port microgrids. These innovations, such as GE Vernova's SeaStream[™] and Digital Suite Operations+, are crucial for meeting the International Maritime Organization's greenhouse gas (GHG) reduction targets and aligning with global sustainability goals.

Our final contribution on decarbonisation comes from Brunel University's Green Yard Scheduler (GYS), part of the EU's PortForward initiative. The GYS project aims to reduce energy consumption and GHG emissions through improved crane scheduling and container positioning, demonstrating how operational efficiency can support environmental responsibility.

We are looking forward to an exciting two-day event filled with engaging panel discussions and inspiring keynote addresses. This journal aims to capture the spirit of the conference and foster meaningful conversations among industry leaders and innovators.

On behalf of PTI, we warmly welcome you to Rotterdam and we hope you will find SDP 2024 as insightful as ever as we look forward to seeing you at our future events!



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Mawani Ports

Mawani was established as the General Corporation for Ports to oversee and develop Saudi Arabia's ports, enhancing trade and passenger transport. A royal directive initiated the privatisation of the ports, driving efficiency and modernisation. Mawani, now the General Authority for Ports, leads all seaport operations and is aligned with Vision 2030 to transform Saudi Arabia into a global logistics leader, propelling the country to the forefront of the global maritime industry

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Awake.AI

Awake.AI is a Finnish optimisation platform company whose solutions are focused on developing customised AI/ML models to optimise cargo flow through the ports and reduce waiting times and emissions. Awake's AI-driven Logistics Platform is developed to bring together all maritime actors at sea, ports and land, making port operations more efficient, safe and sustainable. For Terminal Operators they optimise port calls with AI insights, for Port Authorities Awake.AI maximises the use of their existing port capacity, for Ship Operators they enable Just-in-Time (JIT) arrival and faster turnaround times and for Cargo Owners they bring full transparency to cargo flow in sea-port-land.



Citymesh

Citymesh is a preeminent Belgian technology company, serving as a pivotal solution partner for business clients with innovative challenges for nearly two decades. Established in 2006, the company specialises in offering both permanent and temporary connectivity solutions, utilising cutting-edge Wi-Fi, 0G, 4G, and 5G technologies. Citymesh operates across various sectors, including industry, logistics, public services, offshore markets, education, healthcare, and smart cities, and extends its services to numerous events and festivals. Citymesh distinguishes itself through its personalised approach and commitment to pioneering projects, such as the Safety Drone project, which leverages 5G technology to control drones that assist emergency services. As a member of the Cegeka group, Citymesh employs over 250 dedicated professionals, committed to delivering innovative solutions to their clients.





Esri

Esri is the world leader in the geographic information system (GIS) software industry. Their software allows port professionals to visually analyse their networks and operations, which results in better, faster decisions that improve efficiency, productivity and profitability. Esri technology also integrates your IT systems into one enterprise application resulting in superior systems integration from the office into the field.

GE Vernova

GE Power Conversion, part of GE Vernova, applies the science and systems of power conversion to help drive the electric transformation of the world's energy infrastructure. Designing and delivering advanced motor, drive and control technologies that help improve the efficiency and decarbonisation of energy-intense processes and systems, helping to accelerate the energy transition across marine, energy and industrial applications. GE Power Conversion is at the heart of electrifying tomorrow's energy.





Kale Logistics Solutions is a global vertical SaaS company, providing a suite of software solutions for the logistics industry. It counts several Fortune 500 companies including large seaports and airports as its customers. With in-depth domain knowledge and technical expertise, Kale has developed a suite of comprehensive digital enterprise solutions. Its flagship product is the Cargo Community Platform, which offers a single source of data to support operational flows, disseminating information to various stakeholders and facilitating the paperless exchange of traderelated data between stakeholders. Kale has offices in India, UAE, Kenya, Netherlands, Malaysia, R. Congo, Colombia, Canada and the US. It engages with 5500+ clients in 40+ countries.



Panasonic Connect Europe

Panasonic Connect Europe strives to link businesses to a brighter future by integrating cutting-edge technologies with their specialised hardware. Drawing on their extensive manufacturing history and expertise, they deliver advanced services that add value, solve challenges, and contribute to a more sustainable future for our customers.

At the forefront of rugged technology, the TOUGHBOOK division provides robust, high-performance solutions across industries. Renowned for reliability, their mobile devices redefine productivity in challenging environments. Tailored for the unique demands such as ports and harbours, their expertise drives digitisation, optimising operations industry-wide: crane maintenance, in-vehicle integration, mobility asset tracking and 5G private networks support.

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BRONZE SPONSORS



The Acceleration Agency is the leading digital innovation firm that has the strategic experience, digital expertise, and agility to scale quickly to solve complex business objectives in both consumer and enterprise spaces. They are the leader in Active Digital Twins for real-time visualisation and simulation for a wide range of industries and domains. Their digital expertise delivers scalable and secure solutions that are adaptable and agile while utilising AI/ML, edge computing, and IoT sensors. The Acceleration Agency designs and delivers native products in 3D with gaming engines, web applications, and complete end-to-end platforms for advanced visualisation, enabling simulations and real-time data-driven decision support. They are biased to action and their clients include some of the biggest brands in the world: Disney, Carnival, Universal, and more.

Alliance for private networks

The

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Acceleration

The Alliance for Private Networks

The Alliance for Private Networks is championing the global industry adoption of private networks by educating the ecosystem and providing publicly available tools that ease deployment, such as:

- Uni5G technology blueprints leverage 3GPP 5G standards to define profiling and classification requirements, enabling industry verticals to efficiently deploy their own optimised, reliable, and secure 5G private network in any available spectrum.
- Their unique global PLMN-ID simplifies the path to private network deployment and accelerates the ecosystem.
- Acting as a 3GPP Market Representation Partner, the Alliance welcomes alignment with industry organisations that share their vision for global private network adoption in any available spectrum.



Brunel University London

Brunel University London is the birthplace of the Green Yard Scheduler (GYS), an innovative solution to promote the sustainability and productivity of container terminals in their transition to net zero. As a dynamic and research-intensive university with global ambitions, Brunel University London fosters far-reaching networking, global collaborations, and research impact. Following the successful implementation of the GYS at the Port of Vigo in Spain, Brunel University London seeks to promote its reach and impact through pilot testing and implementation in other ports.



GISGRO is a

GISGRO is a pioneering Finnish SaaS company offering a new-generation Port Management Information System based on port Digital Twin. GISGRO is the most visual and intuitive PMIS System for all port departments and is used in 50 ports around 12 countries concentrating on business-critical operations.



Moffatt & Nichol

Moffatt & Nichol is a multidisciplinary, full-service professional services firm that has expertise in structural, marine, and waterfront facilities; civil, coastal, mechanical, and electrical design; marine construction cost engineering; and inspection and rehabilitation. Moffatt & Nichol provides creative and practical solutions in the field of port engineering. Moffatt & Nichol, a recognized leader for over 75 years in the planning, design, and operations of ports and maritime infrastructure, has played a vital role in developing terminal and waterfront facilities worldwide. From the advent of containerisation to today's complex goods movement trends, environmental regulations, and sophisticated technologies, Moffatt & Nichol has built an international reputation for providing innovative solutions to support virtually any port, maritime, or freight transportation assignment.

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SSH Communications

SSH is a leading defensive cybersecurity company that secures communications and access for and between humans, systems, and networks. Their customers include a variety of enterprises, ranging from Fortune 500 companies to SMBs across sectors such as Finance, Retail, Industrial, Critical Infrastructure, Healthcare, and Government, including leaders in providing industrial machinery for ports and services for global shipping. They help their customers secure their business in the hybrid cloud and distributed IT and OT infrastructures. Their biometric, passwordless, and keyless PrivX Zero Trust solutions reduce costs and complexity while quantumsafe encryption keeps critical connections future-proof. Their teams and partners in North America, Europe, and Asia ensure customer success. The company's shares (SSH1V) are listed on Nasdaq Helsinki.



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Three Group Solutions delivers wholesale, enterprise, and IoT solutions that leverage CK Hutchison's global mobile networks, partner networks, and CK Hutchison's expertise in ports and related services, retail, and infrastructure. CK Hutchison Group Telecom operates the 3 networks in Italy, the UK, Sweden, Denmark, Austria, and Ireland. It also holds a majority interest in Hutchison Telecommunications Hong Kong Holdings Limited (HTHKH), providing cutting-edge mobile services in Hong Kong and Macau. Hutchison Asia Telecom (HAT) comprises CK Hutchison's mobile operations in three rapidly growing Asian markets – Indonesia, Vietnam, and Sri Lanka. Hutchison Ports, the world's leading port investor, developer, and operator, is also a member of CK Hutchison Holdings. This unique position enables Three Group Solutions to offer customers the best solution designers, engineers, and go-to-market specialists across CK Hutchison, in addition to market expertise.

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EXHIBITORS



Airwayz

Airwayz revolutionises airspace management with its DynamicUTM technology, enabling scalable multi-drone operations for inspection, monitoring, delivery, emergency response, and more. Their Al-driven system integrates data from manned and unmanned systems, weather services, and local authorities, providing real-time, autonomous decision-making for seamless and safe drone operations. With over 30,000 autonomous flights conducted worldwide, Airwayz is the leading UTM service provider, including for the groundbreaking commercial project at the Port of Rotterdam. Join us to explore how Airwayz can enhance operations, security, and logistics in ports globally.



Tata Consultancy Services

Tata Consultancy Services is an IT services, consulting and business solutions organisation that has been partnering with many of the world's largest businesses in their transformation journeys for over 55 years. Its consulting-led, cognitive powered, portfolio of business, technology and engineering services and solutions is delivered through its unique Location Independent Agile[™] delivery model, recognised as a benchmark of excellence in software development



SentinelDQ

The future of your business depends on high-quality data. SentinelDQ from One Digital Nation is your trusted partner, helping you transform your data burden into digital brilliance. Businesses that rely on data for operational and strategic decision-making are realising the benefits of using our technology to create a competitive advantage. Turn physical into digital; turn impermeable into searchable; turn chaos into wisdom. With round-the-clock quality and compliance monitoring and scoring, SentinelDQ ensures that Data Quality, and the business that depends on it, are never compromised. Use your IQ. Grow your DQ.



XRF

XRF specialises in developing software solutions to aid decision-making for complex scenarios. By leveraging extended reality and artificial intelligence, XRF transforms critical information into visually engaging and easily accessible formats. Their innovative approach has earned an international clientele, including the Port of Valencia, and Saudi Arabia's NEOM Line project.

SPEAKERS



Dino Ablakovic, Director, Microgrid Solutions, GE VERNOVA

Dino Ablakovic is Microgrid Solutions Director with GE Vernova. He is a leading technical expert in the field of power systems with more than 15 years of experience in distribution networks and microgrids in various positions, from research and development to consulting. He has worked on more than 50 microgrid projects worldwide, which involve simulating, designing and consulting on microgrids of all types and sizes. He has published more than 10 papers on related topics for IEEE, Springer and others. He holds an advanced degree in electrical engineering.



Martin Benderson, Chief Partnership Officer, THE MARITIME ANTI CORRUPTION NETWORK

As Chief Partnership Officer, Martin is responsible for scaling MACN's Collective Action initiatives and for stewarding MACN's partnerships with international donor organisations. Martin joined the MACN secretariat in 2014 and has since catalysed and led Collective Action initiatives to tackle Collective Action initiatives in Indonesia and Malaysia and has steered MACN's efforts to establish a Global Port Integrity Platform.



Dr. Jérôme Besancenot, Head of Digital Transition, HAROPA PORT

Dr. Jérôme Besancenot, PhD in Computer Science graduate from Paris University, is Digital Transition Project Director for HAROPA PORT (Le Havre, Rouen and Paris Ports). Expert in maritime IT strategy and single windows, he developed a new generation of Port Community System (PCS) software designed to facilitate vessels and cargo transit through any port: S-WiNG * (Single-Window Next Generation). Jérôme Besancenot leads a community cybersecurity platform project for HAROPA PORT, a competitive advantage for the port in being recognised by customers as a cyber third trusted party, therefore dealing smarter with digital transition.



Bugra Bilginer, Managing Director, LONDON PORT & LOGISTICS CONSULTING

Bugra Bilginer is a seasoned professional in Shipping, Logistics, and Port Management. Currently serving as the Managing Director of LPLC, he works as a consultant and corporate trainer in Ports and Logistics. His career encompasses a diverse range of executive port management skills, including Commercial, Business Development, Operational, Administrative, Engineering, IT, Marine, PR & CR, Automation, Innovation, Investments, and Projects. With a deep understanding of Port Operations, he specialises in managing Container Terminals, Car Terminals, Liquid Bulk Terminals, General Cargo, Dry Bulk, and Project Cargo.



Terry Bills, Transportation Industry Director, ESRI

Terry Bills is the Transportation Industry Director at Esri. He has over 30 years of experience in transportation planning and policy, information technology and GIS. Terry has been with Esri for 15 years, where he provides subject matter expertise and thought leadership in transportation.



Christian Blauert, Global Director Port and Terminal Development, MOFFATT & NICHOL

Christian Blauert is the Global Director of Port and Terminal Development for Moffatt & Nichol. Christian has over 25 years of experience within the maritime industry with a strong focus on container terminal developments, terminal management, automation projects and management strategy as well as business development. Christian joined Moffatt & Nichol having held various C-suite roles, including CEO, for global terminal operators. Christian is a specialist in terminal planning, operational excellence and supply-chain integration, drawing on significant experience working for a broad range of port and terminal operators internationally. Christian also draws on extensive experience in terminal automation, having personally implemented several automation projects at container terminals.

SPEAKERS Continued



Maarten Boot, Policy Advisor, FEPORT

Since 2019, Maarten Boot has been Policy Advisor at FEPORT—the Federation of European Private Port Companies and Terminals, which represents the interests of a large variety of terminal operators and stevedoring companies performing operations and carrying out activities in the seaports of the European Union. At FEPORT, Maarten Boot ensures the functioning of the Environment, Safety and Security Committee (ESSC) and the Customs and Logistics Committees (C&LC). Maarten Boot has studied Political Science (international relations track) and International Law at the Vrije Universiteit Amsterdam, where he developed a strong interest in the functioning of the European Union.



Matteo Boschian Cuch, PhD Student, CENIT (CIMNE), PORT OF BARCELONA

Matteo Boschian Cuch holds a Bachelor's Degree in Aerospace Engineering and a Master's Degree in Mobility Engineering from Politecnico di Milano. He joined the Centre for Innovation in Transport, CENIT, in 2023 as a PhD student in Transport and Sustainable Mobility in the port sector at the Port Authority of Barcelona. In the port authority he works with the Innovation and Strategy department and his research topics are related to intermodal transport, especially concerning the connection between the port and his hinterland by rail, and inland transport emissions calculation in the port area.



Wouter Buck, Head of Customer Digital, PORT OF ROTTERDAM

Wouter Buck is a Manager at the Port of Rotterdam Authority, where he has held various roles including Consultant Digitalization advising other international seaports, Product Owner of various port community and management tools, and Project Manager in supply chain optimisation projects. He currently leads a team dedicated to enhancing supply chain and port call performance through digitisation projects and pilots with customers. Wouter is passionate about integrating strategy and vision into daily operations to create meaningful impact. He resides in Rotterdam with his wife and enjoys playing tennis.



Nico de Cauwer, Secretary General, IPCSA

Nico De Cauwer has been the Secretary-General of the International Port Community Systems (IPCSA) since 1 May 2023. Before his appointment, he served as IPCSA's Representative for Europe and North America in the Executive Committee of IPCSA since mid-2017. Additionally, he is also leading IPCSA's Standards & Technology domain and serves as the Chairman of IPCSA's Message Design Group PROTECT. Nico is a member of the Industry Advisory Board at the Digital Standards Initiative (DSI) of the International Chamber of Commerce (ICC), a participating Expert member of the UN/CEFACT Transport and Logistics Domain, and an IPCSA delegate who also resides in the IMO Expert Group on Data Harmonisation (EGDH) of the International Maritime Organisation (IMO). Nico is also a member of the Data Collaboration Committee at IAPH, the International Association of Ports and Harbors. As Business Architect Port Community Solutions at the Port of Antwerp-Bruges, he has 30 years of experience in the port and maritime sector, involved in a wide variety of digitalization and innovation projects. He holds a master's degree in mathematics and computer sciences from the University of Antwerp.



Kaj de Groot, Head of Automation Projects, PORTWISE

Kaj de Groot works as Director of Automation Projects at Portwise. He has worked in the ports and terminals field for about nine years and has been involved in terminal design, decarbonisation and automation implementation projects.



Jan Egbertsen, Innovation Manager, PORT OF AMSTERDAM

Jan Egbertsen has studied Management and Logistics at the University of Twente. He works as Strategy and Innovation Manager for the Port of Amsterdam. Jan is among others responsible for digitalisation, energy transition and transport.



Paul Gerken, IT Project Manager, BREMENPORTS GMBH & CO. KG

Paul is working with the port management company bremenports GmbH & Co. KG for the ports of Bremen and Bremerhaven. In his role as IT Project Manager, he is taking care of both bremenports internal and external digitalisation projects within the Smartport initiative. He holds a Master's degree in industrial engineering and management and has profound expertise in logistics digitalisation projects from his previous employment as a research associate at the University of Bremen.



Matthias Hinz, Smart Port Coordinator, BREMENPORTS GMBH & CO. KG

In his role as Smartport Coordinator, Matthias is managing the Digital Transformation Initiative of the Ports of Bremen and Bremerhaven. Matthias is employed at the port management company bremenports GmbH & Co. KG, working in close cooperation with the port authority, terminal operators, logistics service providers and all major stakeholders of the ports who form the Smartport Community. He studied Naval Architecture and Industrial Engineering and is teaching Innovation Management at the University of Applied Sciences in Bremen. Matthias started his career in IT consulting with a focus on project and change management and then worked with a global logistics provider prior to his current role as Smartport Coordinator for bremenports.



James Hosken, Client Executive, GISGRO

With a five-year track record in port digitisation projects, James Hosken, Client Executive at GISGRO, excels in building strong client relationships and delivering successful projects. His ability to simplify technical complexities empowers ports to seamlessly integrate digital solutions into their daily workflows.



Norbert Klettner, Vice President, TIC 4.0

Norbert has been working for more than 15 years in the port and terminal industry implementing and integrating Terminal Operating Systems (TOS), initially for the terminal operator EUROGATE, and since several years as the Managing Director of the RBS EMEA Office implementing the TOPS Expert system. With akquinet port consulting as well, he has moved into the area of using data for simulation and emulation purposes on the CHESSCON suite. Norbert has been a founding member of TIC4.0 since 2018 and is the Vice-President of TIC4.0, as well as a member of the Executive and Operation Councils of TIC4.0.



Kevin Kruijthoff, Managing Director / Director of Product & Technology, ROUTESCANNER

Kevin Kruijthoff is a complexity simplifier passionate about removing waste from the logistics supply chains, with over a decade of experience in decision support system development. He drives applicable R&D with a focus on effective time to market. He holds an MSc from TU Delft in Engineering & Policy Analysis and has a broad background in development, technology and data science applications for the port and logistics realm. He worked at the Port of Rotterdam in the IT, commercial and innovation departments in various roles, from which Routescanner was initiated in 2021. He has been responsible for its product and development from the start and since the start of 2024 has acted as the Managing Director for Routescanner as a whole. Kevin's mission is to empower shippers and forwarders of all sizes to find their optimal container routes.



Umesh Kurlekar, VP- Head of Maritime Practice, KALE LOGISTICS

Umesh Kurlekar brings with him more than 20 years of experience in port operations and shipping lines. He spearheads the CODEX Port Community System (PCS) development for global markets. Executed under his leadership, CODEX has been recognised by esteemed institutions like the United Nations, Asian Development Bank and CII for its innovation in Trade Facilitation.

SPEAKERS Continued



Starr Long, Executive Producer, THE ACCELERATION AGENCY

Starr Long has been making video games and technology for over 30 years. During his career, he helped start the MMO industry and has created some of the largest Active Digital Twins ever built. Starr was the Project Director of Ultima Online, which is now the longest-running MMO in history and holds eight Guinness World Records. Starr has led teams at Electronic Arts, The Walt Disney Company, and NCSoft. Starr currently works at The Acceleration Agency (taa.io) whose clients include Carnival Corporation, Universal, Disney, INVI Mindhealth, Circuit of the Americas, the Port of Corpus Christi and more.



Thorsten Lutz, Solution Architect, PANASONIC TOUGHBOOK

Mobility expert since digitalisation started in mobile communication. The span is from modern networks, identification and verification to 5G smartphones with the supporting elements of services and solutions in mobile IT.



José Andrés Giménez Maldonado, Director of Port Logistics, FUNDACIÓN VALENCIAPORT

José Andrés Giménez is an Industrial Engineer and has 17 years of experience in the logistics port sector, developing innovation and research projects focused on the fields of port logistics and maritime transport. His fields of expertise are related to increasing the efficiency of logistics and port operations through the development of Industry 4.0 models and technologies (IoT, Big Data, Artificial Intelligence, Process Automation, etc.). He has been Director of Energy and Security and he is currently developing his work as Director of Port Logistics at the Valenciaport Foundation (Port of Valencia). He is currently Secretary General of the International Association Terminal Industry Committee (TIC4.0), an entity that brings together global container terminal operators along with port machinery manufacturers and developers of digital solutions.



Afshin Mansouri, Professor of Operations & Supply Chain Management, BRUNEL UNIVERSITY LONDON Afshin is a Professor of Operations and Supply Chain Management at Brunel University London. Over the past decade, he has led several projects in the area of sustainable maritime shipping. In the EU project PortForward, Afshin has successfully led the development of The Green Yard Scheduler (GYS) to enhance the sustainability and productivity of container terminals for the first implementation at the Port of Vigo in Spain. He is actively seeking to promote the reach and impact of the GYS through its pilot testing and implementation in other ports.



Ori Marom, Program Manager of New-Mobility at the Innovation Department, PORT OF ROTTERDAM Ori serves as a Board Director at SAE Industry Technologies Consortia. At the Port of Rotterdam, he is responsible

Ori serves as a Board Director at SAE Industry Technologies Consortia. At the Port of Rotterdam, he is responsible for the integration of connected autonomous machines, such as autonomous vessels and drones, into port systems. Before joining the port, he was a start-up entrepreneur and served on the faculty of the Rotterdam School of Management at Erasmus University.



Kevin Martin, CEO, ONE DIGITAL NATION

Kevin Martin is a visionary leader with extensive technology leadership experience in ports and supply chains. Kevin has diversified from pure-play consultancy, forming One Digital Nation to pioneer innovative solutions that empower organisations to harness the power of current and emerging digital technologies for strategic growth and operational excellence.



Angel Martinez, Senior Product Manager, NEXTPORT.AI

Angel Martinez is a Telecommunication Engineer with an extensive background in consultancy applied to Maritime Transport and Logistics, as well as applied R&D activities related to Technology. Before NextPort.ai Angel worked for companies like CapGemini or ProDevelop, providing consultancy services and developing technology for Ports and Terminals. In NextPort, as Senior Product Manager Angel leads currently a cross-functional team developing DigitalTwin and Artificial Intelligence solutions for ports.



Manuel Martinez de Ubago Alvarez de Sotomayor, Business Manager & Product Strategy, NEXTPORT.AI

Manuel Martinez de Ubago joined Moffatt & Nichol to lead the Business Development and Product Strategy of the Technology offering, with a significant focus on NextPort as a key investment. Previously he worked at the STC Group in the Netherlands. Before that, he held positions in different private organisations in the port and logistics fields, as well as in the United Nations. He holds an MSc in Civil Engineering and another MSc in Transport & Logistics at the TU Delft, in the Netherlands.



Jesús Medina Blanco, Chief Information & Innovation Officer, ALGECIRAS PORT AUTHORITY

Jesús Medina is a Telecommunication Engineer from the University of Seville, holds an MBA with a speciality in Logistics and Transportation from the IMF Business School and has a proven track record with more than 15 years of experience in the field of consulting, technology, digital transformation, and innovation, mainly focused on the logistics-port sector. He has completed his training with many certifications such as Prince2 Practitioner and ITIL Intermediate. He is currently Chief Information & Innovation Officer at Algeciras Port Authority where he joined in 2018. He is in charge of leading the digital transformation and fostering the innovation culture at Algeciras Port Authority. He is focused on the integration of business, technology and innovation to improve the port's competitiveness and offer superior quality of service.



Koen Mioulet, Consultant and Founder/Secretary of Association, EUWENA

Koen Mioulet (NL) graduated in Mechanical Engineering and Business Administration in 1984. After some assignments in heavy industry, he switched to telecoms and worked for employers like Ericsson, Nortel and Powerwave in the telecoms industry and notably in the wireless domain. As of 2006, he works as an independent consultant under his label UIWiMo (Ultimate Wireless Mobility).

In 2021, with eight peers and specialists from the sector he founded EUWENA, the European Users of Wireless Enterprise Networks Association. The association strives for the acceleration of the ecosystem and market development in the emerging niche of private mobile networks.



Massimo Nardone, Vice President of Operational Technology (OT) Security, SSH COMMUNICATIONS SECURITY

Massimo Nardone serves as the Vice President of Operational Technology (OT) Security at SSH Communications Security Plc. He collected more than 29 years of working experience in the IT/OT/IoT cybersecurity environments in multiple cybersecurity leadership positions like CISO, Lead Architect, OT/IoT/IIoT Global Security Competence Leader, etc. helping many clients to understand their IT/OT/IoT/IIoT cybersecurity risks/impacts and how to mitigate them by developing and leading security programmes. He has a deep understanding and practical knowledge of security standards and frameworks like ISO2700 series, NIST series, IEC 62443, IEC 61508, ANSSI, COBIT, PCI Dss, CIS controls, HIPAA, etc. as well as security regulations and directives like GDPR, DORA, NIS2, and more.



Maxim Neiser, Project Manager, HPC HAMBURG PORT CONSULTING

Maxim Neiser is a Project Manager at HPC Hamburg Port Consulting, a leading global port consultancy based in Hamburg, Germany. Maxim has over 10 years of experience in the shipping and transport industry, combining in-depth knowledge of port call optimisation and port and terminal operations. For the last three years, Maxim has been acting as Product Owner for the port call collaboration platform of the Hamburg Vessel Coordination Center GmbH a unique public and private cooperation towards port call optimisation in the Port of Hamburg.



Elisa Romero González, Environmental Technician, Works and Blue Economy Department, PORT OF VIGO

Elisa has been working for the Port of Vigo for five years as an Environmental Technician in the implementation of European projects developed by the port in the framework of its Blue Economy Strategy. During this time, she has participated in more than 10 innovation projects (H2020, Interreg and national calls). Prior to this, she worked for 12 years in the field of environment, waste management and circular economy, developing technical, research and training activities.

SPEAKERS Continued



Hans Rook, Ambassador, IPCSA

Hans has worked in the transport and logistics sea trade sector for 52 years. He started his career at a shipping agency and having gained experience in all facets of import and export services, he was appointed to set up the ICT function in the company. He is also one of the gurus on EDI standardisation—he joined UN working groups to establish UN/CEFACT EDIFACT messages for the global sea trade industry. Having been General Manager of ICT within the shipping agency, Hans was asked to join the Rotterdam group of experts for the set-up of the Port Community System in the Port of Rotterdam. Since then, he has been working for Portbase Rotterdam until January 2019 when he retired. Hans is quite simply one of the visionaries in the development of new services to support the simplification of trade. Hans, retired from Portbase Rotterdam at the beginning of 2019 where he was senior adviser at Portbase, the Port Community System in The Netherlands.



Chiara Saragani, PhD Student, CENIT (CIMNE), PORT OF BARCELONA

Chiara Saragani is an Industrial Engineer from the University Alma Mater Studiorum of Bologna. She joined the Centre for Innovation in Transport, CENIT, in 2022 as a PhD Student in Digitalization and Logistics in the port sector at the Port Authority of Barcelona. In the Port Authority, she works with the Innovation Department and her research is focused on new technology solutions for improving the logistics activities of the ports. In particular, she is studying Digital Twins, Artificial Intelligence and 5G connection as main topics.



Arvin Singh, VP Global 5G Solutions & Innovation, VERIZON

Arvin Singh is the Head of Global 5G Solutions Engineering at Verizon Business Group, where he leads a dynamic team of architects, engineers, and thought leaders. With a focus on accelerating the adoption of emerging technologies such as private wireless networks and multi-access edge compute (MEC) capabilities, Arvin's team is at the forefront of delivering Verizon's cutting-edge technology strategy and vision. His role involves conducting innovation workshops, designing advanced solutions, and driving impactful business outcomes by leveraging Verizon's comprehensive portfolio of technological assets. With over 25 years of experience in information, communications and wireless technologies across various industry segments, Arvin brings a wealth of knowledge and expertise to his position.



Karno Tenovuo, CEO, AWAKE.AI

Karno Tenovuo has been in the marine business since 2004 and launched several groundbreaking solutions to the market. Now he is the CEO of Awake.AI. For the first seven years of his career, he worked at the Finnish shipyards leading R&D and business development. Then he started his own company and Rolls-Royce became one of his customers and was soon offered a global role heading business development and strategy based in Norway. Two weeks after starting in that role, Karno started the research on future ship operations and then grew that into the Ship Intelligence business where was the SVP and P&L owner. Some highlights include a project with Maersk & Svitzer that demonstrated the world's first remotely controlled commercial vessel, Stena and MOL cooperation around an intelligent awareness system, Safer Vessel with Autonomous Navigation (SVAN) project with Finnferries that was the first autonomous commercial ship demonstration in the world. Then he realised that smart ships cannot interact with the rest of the logistic chain unless the needed digital handshakes are being developed and linked to an open platform. And so, Awake.AI was born.



Joeri Tranchet, COO, CITYMESH

Joeri Tranchet is the Chief Operating Officer at Citymesh, where he is responsible for driving operational strategy and optimising business processes. With extensive experience in technology and operations management, he plays a key role in strengthening Citymesh as a leading telecom operator in Belgium. Joeri focuses on enhancing efficiency and fostering innovation, enabling the company to deliver high-quality connectivity solutions across various sectors. His leadership is a driving force behind the successful implementation of advanced technologies within the organisation.



Boris Wenzel, President, TIC 4.0

Boris is a seasoned CEO with a strong focus on strategy and change management. He has 20 years' experience in senior leadership positions in Asia and Europe backed by early experience as a turn-around specialist and a proven track record in building successful teams and creating shareholder value. He has multi-industry, multi-company and multi-continent experience in diverse cultural environments and solid experience representing the interests of financial institutions and PE-type investors. He is a passionate communicator who can build trust and convince stakeholders to envision and support important transformations of the business or of the industry. Boris holds extensive negotiation and lobbying experience dealing at the top governmental levels in Europe, Asia and South America, as well as EU institutions.



Graham Wilde, Head of 5G Business Development, THREE GROUP SOLUTIONS

Graham Wilde is Head of 5G Business Development at Three Group Solutions, a global telecoms unit of CK Hutchison. He is responsible for Private Network development coordination across the Hutchison Group of mobile operators. He also works closely with Hutchison Ports on digitisation and automation projects across the company's ports in 27 countries. Prior to joining Three Group Solutions, Graham was Managing Director at UK Broadband, a company which had been acquired by Three UK, and operates private 4G networks at the Port of Felixstowe, Heathrow Airport and the Port of Immingham in the UK. His earlier career was spent at Logica UK (now CGI), Nortel Networks Hong Kong, and as an independent consultant in telecommunications. He has a bachelor's degree in Experimental Psychology from the University of Oxford, UK. He once played the drums for the late Curtis Mayfield.



Eyal Zor, Co-founder and CEO, AIRWAYZ

Eyal has more than 20 years of experience with unmanned vehicles and airspace management. Before founding Airwayz, Eyal served in the IAF as an Airborne Air-Traffic Controller, ranked major (res.), and also has Previous experience in the Autonomous drones industry. Eyal holds a B.A in Business & Economics from Berkeley California & IDC Herzliya.



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TRANSFORMING PORTS WITH PRIVATE 5G NETWORKS: EMPOWERING SMART PORTS 4.0



Mehdi Quraishi, Director, Verizon Business

INTRODUCTION

In the evolution towards Port 4.0, private 5G networks emerge as a cornerstone of modern industrial connectivity solutions. Tailored specifically for industrial environments, these networks offer unparalleled advantages over traditional wired or Wi-Fi setups. They are meticulously optimised for IoT applications, boasting Iow energy consumption, fortified data security, and robust support for high connection densities.

IMPORTANCE OF PRIVATE 5G NETWORKS IN SMART PORTS

Smart ports epitomise the need for resilient network infrastructures capable of managing vast streams of data from interconnected workers and machinery such as cranes and vehicles. A private 5G network stands out by delivering the necessary bandwidth and minimal latency crucial for sustaining mission-critical operations. This includes enabling Digital Twins and automating asset management processes with precision and efficiency.

Moreover, private 5G networks excel in facilitating seamless mobility within ports as equipment becomes increasingly interconnected, continuously generating real-time data. By minimising handover times and ensuring uninterrupted data flow, 5G networks enhance operational efficiency across the port's extensive infrastructure. This capability supports swift and continuous communication, optimising resource allocation and enhancing overall productivity.



"IN THE ERA OF SMART PORT 4.0, PRIVATE 5G IS THE BACKBONE THAT ENABLES THE SEAMLESS INTEGRATION OF ADVANCED TECHNOLOGIES, ALLOWING PORTS TO OPERATE SMARTER, FASTER, AND GREENER."

THE IMPACT OF PRIVATE 5G NETWORKS ON PORT OPERATIONS

The convergence of private 5G networks, IoT advancements, and automation marks a revolutionary shift in maritime logistics and port operations. Ports, as pivotal hubs in global trade and logistics networks, are embracing these technologies to elevate operational efficiencies, streamline resource management, and fortify safety measures. This white paper delves into the transformative impact of private 5G networks on smart ports, exploring their benefits, navigating implementation challenges, and outlining future prospects.

EXPLORING INDUSTRY 4.0 POTENTIAL: KEY USE CASES FOR SMART PORTS

In this section, we delve into five pivotal use cases that highlight the transformative potential of Industry 4.0 technologies in smart ports. While these examples are impactful, they represent just a glimpse into the vast array of possibilities for enhancing smart port operations.

1. REMOTE-CONTROLLED SHIP-TO-SHORE CRANES

Traditionally, remote-controlled ship-to-shore (STS) cranes rely on a mix of WiFi and fibre optic connections. However, fibre optics are prone to damage and expensive to repair, leading to higher operational costs and safety risks. By fully digitalising information exchange among the remote operator, checker, and deckman, a robust private 5G network enables seamless integration and real-time control of STS cranes from a centralised control room, ensuring efficient and streamlined dockside operations.

Implementation Requirements

To fully leverage the capabilities of private 5G networks, each dockside container crane needs to be equipped with advanced technologies:

- 3D Sensors: These sensors provide detailed spatial awareness, crucial for the precise control of crane movements.
- HD Cameras: Numerous high-definition cameras are necessary to provide real-time video feeds to the remotecontrol room, ensuring clear visibility of crane operations.
- Optical Character Recognition (OCR): OCR technology is used to identify containers, reducing the need for manual checking and speeding up the handling process.

Key Benefits of Private 5G for STS Cranes

- **Real-Time Control:** With low latency and high bandwidth, private 5G networks facilitate real-time control of STS cranes, ensuring precise and responsive operations.
- Enhanced Operational Efficiency: The seamless integration of information exchange allows for more efficient dockside operations, reducing downtime and increasing throughput.
- **Improved Safety:** Reliable 5G connectivity minimises the risk of sudden communication failures, thereby enhancing the safety of port workers and equipment.

2. AUTOMATED GANTRY CRANES

Automated gantry cranes are integral to the efficient functioning of modern ports. These cranes, which move containers to and from ships, trucks, and storage areas, are pivotal for handling the immense volume of cargo that passes through ports daily. Traditionally, these cranes have relied on wired and WiFi connections, which pose significant limitations. The adoption of private 5G networks can revolutionise the operations of automated gantry cranes, offering improved efficiency, reliability, and safety.

Implementation Requirements

To maximise the benefits of private 5G networks, automated gantry cranes should be equipped with the following technologies:

- Advanced Sensors: Highprecision sensors for real-time monitoring of crane operations and environment.
- HD Cameras: Cameras to provide live video feeds to control centres, ensuring accurate and safe crane operations.
- Machine Learning Algorithms: Integrated with private 5G, these algorithms can analyse data in real time to predict maintenance needs and optimise crane movements.

Key Benefits of Private 5G for Automated Gantry Cranes

- Enhanced Real-Time Control: The low latency of private 5G networks ensures that automated gantry cranes can be controlled in real time, enabling precise and swift operations.
- Increased Operational Efficiency: With highbandwidth connectivity, large amounts of data from sensors and cameras can be transmitted seamlessly, optimising crane movements and reducing idle times.
- Improved Reliability and Safety: The robust and secure nature of private 5G networks minimises the risk of connectivity failures, enhancing the overall safety and reliability of crane operations.
- Cost-Effective Maintenance: Eliminating the need for extensive wired infrastructure reduces maintenance costs and operational downtime.

3. AUTOMATED GUIDED VEHICLES (AGVS)

Automated Guided Vehicles (AGVs) are revolutionising port operations by automating the movement of containers and cargo within the port terminal. These driverless vehicles enhance efficiency, reduce labour costs, and improve safety. However, the successful deployment and operation of AGVs depend heavily on a reliable and highperformance communication network. Private 5G networks provide the ideal solution, offering the necessary bandwidth, low latency, and robust connectivity required for optimal AGV performance.

Challenges with Traditional Technologies

• **Connectivity Reliability:** WiFi networks can suffer from interference and limited coverage, leading to communication dropouts that disrupt AGV operations.

- Latency Issues: High latency in traditional networks can result in delayed responses from AGVs, affecting their precision and efficiency.
- Scalability Limitations: Traditional networks struggle to handle the high density of connected devices in a port environment, limiting the scalability of AGV deployments.
- Security Concerns: Ports need secure communication channels to protect sensitive operational data from cyber threats, which traditional networks may not fully guarantee.

Implementation Requirements

To fully leverage private 5G networks for AGV operations, ports

need to equip their AGVs and infrastructure with the following technologies:

- Advanced Sensors: Equipped with various sensors, AGVs can collect real-time data on their surroundings, operational status, and cargo conditions.
- HD Cameras: High-definition cameras on AGVs provide live video feeds for remote monitoring and control, enhancing operational oversight.
- Machine Learning Algorithms: Integrated with 5G, these algorithms can process real-time data to optimise AGV routes, predict maintenance needs, and improve overall efficiency.

Key Benefits of Private 5G for AGVs

- Seamless Connectivity: Private 5G networks offer consistent and reliable connectivity across the entire port, minimising communication dropouts and ensuring continuous AGV operation.
- Ultra-Low Latency: With latency as low as 1 millisecond, private 5G networks enable real-time control and immediate response to commands, crucial for the precise operation of AGVs.
- High Bandwidth: The high data transfer rates of 5G networks support the transmission of large volumes of data from AGV sensors and

"THE CONVERGENCE OF PRIVATE 5G NETWORKS, IOT ADVANCEMENTS, AND AUTOMATION MARKS A REVOLUTIONARY SHIFT IN MARITIME LOGISTICS AND PORT OPERATIONS."



cameras, facilitating advanced analytics and real-time decision-making.

- Enhanced Security: Private
 5G networks provide robust
 security features, protecting
 AGV communications from
 cyber threats and ensuring data
 integrity.
- Scalability: Private 5G networks can support a high density of connected devices, allowing ports to scale up their AGV fleets without compromising performance.

4. CONDITION MONITORING SYSTEMS

Condition monitoring systems are critical for maintaining the operational health of port infrastructure and equipment. These systems continuously collect and analyse data on the condition of machinery, structures, and vehicles, enabling predictive maintenance and preventing costly downtime. The implementation of private 5G networks significantly enhances the capabilities of condition monitoring systems by providing reliable, high-speed, and lowlatency communication essential for real-time data processing and decision-making.

Challenges with Traditional Technologies

 Data Latency: Traditional networks often suffer from high latency, leading to delays in data transmission and processing, which can impact the timely detection of potential issues.



- Limited Coverage: WiFi and wired networks may not provide comprehensive coverage across extensive port areas, resulting in gaps in monitoring and data collection.
- Scalability Issues: Traditional network infrastructures struggle to handle the high volume of data generated by numerous sensors and monitoring devices deployed across the port.
- Security Vulnerabilities: Ports require secure communication channels to protect sensitive operational data from cyber threats, a challenge for older network technologies.

Implementation Requirements

To effectively utilise private 5G networks for condition monitoring, ports need to deploy the following technologies:

- Advanced Sensors: Sensors capable of monitoring various parameters such as temperature, vibration, pressure, and humidity, providing comprehensive data on the condition of equipment and infrastructure.
- Edge Computing: Integration of edge computing devices to preprocess data at the source, reducing latency and bandwidth usage by transmitting only relevant data to central systems.
- Analytics Software: Software platforms capable of realtime data analysis, predictive maintenance algorithms, and automated alerts to ensure timely intervention and maintenance.

Key Benefits of Private 5G for Condition Monitoring Systems

- Real-Time Data Transmission:
 Private 5G networks enable instant data transmission from sensors and monitoring devices to central control systems, allowing for immediate analysis and response.
- Comprehensive Coverage: Private 5G networks provide extensive and reliable coverage across the entire port, ensuring that all areas and assets are

continuously monitored.

- **High Data Throughput:** The high bandwidth of 5G networks supports the transmission of large volumes of data, essential for detailed condition monitoring and predictive analytics.
- **Enhanced Security:** Private 5G networks offer robust security features, ensuring that data collected from monitoring systems is protected from cyber threats.
- Scalability: Private 5G networks can support a large number of connected devices, allowing for extensive deployment of condition monitoring sensors without performance degradation.

5. DRONES FOR SURVEILLANCE AND DELIVERIES

Drones have emerged as versatile tools in port operations, serving dual purposes of surveillance and logistics. With the integration of private 5G networks, drones equipped for surveillance and deliveries can enhance security measures and operational efficiency within ports. This use case explores how private 5G networks enable real-time data transmission, precise control, and secure communication for drones operating in port environments.

Challenges with Traditional Technologies • Limited Range and

- **Coverage:** Traditional drone communication technologies, such as WiFi or standard cellular networks, often have limited range and coverage, restricting their operational capabilities within large port areas.
- Latency Issues: Delayed data transmission can impact the effectiveness of real-time surveillance and logistics operations, compromising response times and decisionmaking.
- Security Concerns: Standard

networks may lack the robust security measures required to protect sensitive data transmitted between drones and control centres, posing risks to operational integrity.

Key Benefits of Private 5G for Drones in Ports

- Real-Time Surveillance:
 Private 5G networks enable
 drones to stream high-definition
 video and sensor data in
 real-time to port security
 centres, enhancing monitoring
 capabilities and threat detection.
- Precise Navigation and Control: Low-latency communication ensures precise control of drones, allowing operators to manoeuvre effectively around port infrastructure and obstacles.
- Extended Range and Coverage: Private 5G networks provide broader coverage across the port area, enabling drones to operate over larger distances without signal degradation.
- Enhanced Security: Advanced encryption and authentication protocols in private 5G networks protect data transmission between drones and control centres, safeguarding sensitive information.

CONCLUSION

Private 5G networks are poised to revolutionise smart ports, offering unparalleled connectivity solutions tailored for Industry 4.0 applications. By integrating private 5G, ports can enhance operational efficiency, improve safety protocols, and pave the way for future innovations in global trade and logistics networks. The benefits span from real-time control of critical operations to enhanced data security and scalability, ensuring that smart ports remain at the forefront of industrial innovation.

As smart ports continue their evolution towards greater automation and efficiency, private 5G networks will play a pivotal role in unlocking new possibilities and efficiencies. Embracing this technology is not just a step towards digital transformation but a strategic move to future-proof port operations amidst evolving industry demands and technological advancements.

ABOUT THE AUTHOR:

Mehdi Quraishi is the Director of 5G, Edge Solutions, and Innovation at Verizon Business Group, leading a team that drives the adoption of private networks and multi-access edge computing. He spearheads Verizon's cutting-edge technology strategy, designing advanced solutions to achieve impactful business outcomes. With over 25 years of experience in ICT and wireless, Mehdi is a recognised industry leader, deeply committed to advancing 5G and fostering innovation.

ABOUT THE COMPANY:

Verizon Communications Inc. (NYSE, Nasdaq: VZ) powers and empowers how its millions of customers live, work and play, delivering on their demand for mobility, reliable network connectivity and security. Headquartered in New York City, serving countries worldwide and nearly all of the Fortune 500, Verizon generated revenues of \$134 billion in 2023. Verizon's worldclass team never stops innovating to meet customers where they are today and equip them for the needs of tomorrow.

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"PRIVATE 5G NETWORKS ARE POISED TO REVOLUTIONISE SMART PORTS, OFFERING UNPARALLELED CONNECTIVITY SOLUTIONS TAILORED FOR INDUSTRY 4.0 APPLICATIONS."

SMART PORTS: HOW 5G AND IOT CAN REVOLUTIONISE GLOBAL TRADE

"5G SERVES AS THE CONNECTION THAT LINKS HUMANS, DATA, CARGO, AND MACHINERY IN REAL TIME AND WITH TOTAL OPERATIONAL VISIBILITY."

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Panasonic

Thorsten Lutz, Solution Architect – Panasonic TOUGHBOOK

Ports and harbours are the lifeblood of global trade, handling the vast majority of the world's freight. The integration of cuttingedge technology, specifically the Internet of Things (IoT) and 5G, is set to revolutionise these essential nodes in the supply chain, transforming them into "Smart Ports".

THE SHIPPING FORECAST

Ports and harbours serve as pivotal channels for trade, freight, and logistical operations. Facilitating the transportation of cargoes such as oil, bulk commodities, perishables, and standardised containers, they are a linchpin of international supply chains.

Keeping operations running smoothly and trade buoyant is already a complicated challenge. Port and harbour operators need to coordinate a vast network of vehicles, equipment,

systems, people, and machinery both onshore and offshore.

With so many moving parts, clear communication, accurate logistical movement, and timely actions are of the highest importance.

CHALLENGES AHEAD

Global freight demand is expected to triple by 2050, significantly increasing the complexity and risks of port operations. This surge necessitates improved asset visibility and optimised yard and terminal operations. With the expected 50 per cent increase in cargo throughput at EU ports by 2030, the safety and efficiency of



port operations will be paramount. From a technological

perspective, the challenge lies in fortifying and transforming digital infrastructure and operations to better navigate this escalating demand and volume of trade. The solution, or at least a crucial part of it, lies in the development of 'Smart Ports,' fuelled by the integration of cutting-edge technology and data into every aspect of operation.

SMART PORTS AND IOT

Ports are undergoing a digital transformation, driven by the need for operational efficiency, cost reduction, and enhanced safety measures. IoT has emerged as a key enabler in this transformation, offering real-time monitoring and management of assets, including terminal tractors, reach stackers, container handlers, cranes, containers, lorries, and personnel.

loT's ability to connect sensors, data streams, and digital devices allows for comprehensive visibility and management of all terminal operations, significantly enhancing efficiency and reducing the risk of unexpected downtime.

RISING DATA DEMANDS

As powerful as the benefits of IoT are, the scale of rollout needed to link all the necessary elements of ports and harbours comes with significantly greater connectivity demands. Additionally, the physical nature of ports and harbours brings further challenges that encumber mobility and impede the efficacy of these technologies.

Due to the size of ports, tracking the movement of containers, vehicles, people, and equipment requires a network that can span several kilometres and keep devices and sensors always connected.

But scale is only half the battle. The constant movement of dense, bulky objects can obstruct signals and interrupt data connections. Dead spots can appear "out of nowhere", causing unexpected disruption and delays, as well as safety issues.



"POWERED BY A 5G PRIVATE NETWORK, THE INTERCONNECTION OF EVERY FACET OF HARBOUR ACTIVITY, FROM THE BUSTLING TERMINALS TO MARITIME VESSELS, CAN USHER IN A NEW FUTURE OF SMART PORTS."

WiFi and Bluetooth simply aren't designed to support networks of this size and nature. Likewise, using public cellular 4G networks for communication isn't a viable option either. A lack of reliability and control, having to share the network with other users in the vicinity,

and the uncontrollable variable of security vulnerabilities are just some of the limitations and concerns that would make it unfeasible.

The benefits of a fully connected asset ecosystem within ports and the wider supply chain are clear to see. However, achieving this in practical terms is not without its challenges. To fully capitalise on the power of IoT and usher in a new era of 'Smart Ports' requires a network that goes beyond the capabilities of WiFi, Bluetooth, or 4G.

5G PRIVATE NETWORKS: THE BACKBONE OF SMART PORTS

5th-generation wireless technology (5G) enhances the speed and efficiency of communication between devices, leading to higher mobility and seamless real-time applications. This allows for more efficient use of network resources, improved network slicing capabilities, and better support for massive IoT deployments.

However, there's an important distinction to make between 5G standalone (5GSA) and 5G nonstandalone (5GNSA). With 5GSA, both the core network and the radio access network are designed specifically for 5G technology, enabling advanced features and capabilities. In contrast, 5GNSA, which initially used the 4G infrastructure for certain functions, the optimised 5G network architecture of 5GSA offers faster data speeds, lower latency, and improved network efficiency.

Relying on public 5G networks can bring many of the same competition, security and control limitations associated with 4G networks.

ADVANTAGES OF PRIVATE 5G Networks

5G serves as the connection that links humans, data, cargo, and machinery in real time and with total operational visibility. This enables a new platform for swift and seamless exchanges between vessels, dock teams, harbour control centres, and beyond.

Real-time updates on shipment status, precise location details, and the condition of items in transit emerge as an intrinsic feature, catalysing improved asset tracking



and elevating operational efficiency to unprecedented levels.

Extending this vision beyond the confines of the port perimeter, a wider communication layer that knits together more disparate parts of the supply chain can provide even greater visibility and offer all parties the benefits of real-time tracking and status updates. Likewise, the sharing of information with other businesses, services, and residents in the port's local area can alleviate congestion, improve traffic, and mitigate environmental impacts.

Powered by a 5G private network, the interconnection of every facet of harbour activity, from the bustling terminals to maritime vessels, can usher in a new future of Smart Ports.

THE CRUCIAL ROLE OF 5G MOBILE DEVICES IN SMART PORTS

Connecting all the moving parts of port and harbour operations is only useful if the information is accessible in real time and actionable by those on the ground.

While many processes have been automated and digitised, people still have a massive role to play in the operation of cranes, loaders, vessels, and other equipment all over the port. For them to harness the full spectrum of advantages furnished by interconnected data, teams need powerful and portable devices to assist them wherever they go.

However, ports and harbours are unforgiving environments. They are fraught with dust, rain and saltwater splashes, high vibration levels, sudden impacts, and rough handling. Wet and windy conditions, knocks, drops, and bangs, and interfacing with a variety of different vehicles and equipment are just some of the challenges that mobile devices need to overcome. Outdoor usage also brings considerations around temperatures—from the icy lows of winter to the blistering heat of a crane cockpit during the height of summer.

Overcoming these challenges requires mobile devices that can both fully support 5G networks and withstand the outdoor conditions and hazards that typify the maritime domain.

For over 25 years Panasonic has been at the forefront of rugged innovation, developing devices that are built to bring unparalleled computing power and usability to the harshest of environments. Combining a fully rugged design with built-in 5GSA connectivity and a dedicated 5G Private Network service, Panasonic TOUGHBOOK is the perfect choice for overcoming the challenges of today and unlocking the opportunities of Smart Ports of the future.

CONCLUSION

The convergence of 5G technology, modern yard management supported by video analytics and ruggedised mobile devices paves the way for Smart Ports, transforming maritime operations with unparalleled efficiency and connectivity. The realisation of this vision will significantly enhance global trade, safety, and environmental sustainability, marking a new era in port and harbour operations.

ABOUT THE AUTHOR:

Thorsten Lutz is a true mobility expert, serving, planning and running mobile networks in the early days of GSM (2G) already. Advising and supporting customers from rugged mobility to tablets and smartphones, on any OS. Years of experience in building and developing mobility services and solutions.

ABOUT THE COMPANY:

Panasonic TOUGHBOOK, a leader in rugged computing solutions, offers durable laptops, 2-in-1 and tablet devices as well as accessories for harsh environments. With specialised and customised vehicle integration and 5G private networks, TOUGHBOOK ensures reliable performance for ports and harbours





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🕗 awake.ai

Dr. Petra Virjonen, Data Scientist, Awake.Al, and Dr. Jussi Poikonen, VP of AI & Analytics, Awake.Al

INTRODUCTION

In 2024, Awake AI won the 2024 Moroccan Smart Port Challenge to develop digital solutions for port performance improvement in collaboration with the Moroccan National Ports Agency ANP. The focus of this proof of concept development project was to enable the adoption of just-intime (JIT) scheduling and related performance optimisations in Moroccan ports. To identify where JIT scheduling processes and tools would be most effective, Awake. Al implemented a data analytics procedure to quantify the potential benefits in selected ports.

MOTIVATION

Quite often vessels need to wait before entering a port due to various reasons, such as port restrictions like bad weather or the target berth being occupied by another vessel. Vessels may wait at a designated anchorage area or move slowly near the port for extended periods while waiting for berthing. In many cases, if the actual time when the vessel can arrive at berth was known in advance, the vessels could arrive at a slower, more economical speed, thus saving fuel and money while reducing emissions. Adopting such a just-in-time (JIT) scheduling process requires a change in practices and contractual agreements from the first-come first-serve process traditionally applied in the maritime industry; this is seen by the International Maritime Organization (IMO) as a significant part of port call optimisation and making the industry more sustainable. To

FIGURE 1. Overview of AIS position update data for vessels visiting a target port.



efficiently target JIT optimisation, it is beneficial to understand and quantify the optimisation potential, which varies significantly across different ports, terminals, and cargo types.

DATA

In this study, an analysis was performed in selected Moroccan ports using AIS (Automatic Identification System) and port restriction data for the year 2023. Port restrictions included time windows during which incoming traffic to the port was restricted, for example, due to strong swell or wind. All commercial vessels transmitting AIS data were included in the analysis. Figure 1 shows an example of the AIS vessel location updates near a port, with the point colours indicating vessel speed over ground; anchorage areas, fairways, and berth positions are clearly visible from the location history.

ANALYSIS

Berth and anchorage areas and their usage were determined from the AIS data. The areas were found by recognising locations where the vessels were at anchor or moored according to their AIS navigation status. Separate areas were distinguished using a clustering algorithm, and the bounding area polygons were determined by forming a convex hull over the vessels included in each cluster, taking into account the vessel dimensions reported in AIS data. Berth and anchorage visits for each vessel were determined using the observed berth and anchorage areas and the AIS location data timeline. Vessel speed and orientation values were also utilised when determining whether a data point was part of a continuous berth or anchorage visit.

JIT potential was estimated using a large area encompassing all the observed circling paths



around the port (referred to as "idle area"). For each arriving vessel, the time of entering this area was detected, and it was estimated when the vessel could have been at the target berth if it had travelled the remaining path without any anchorage events or excessive manoeuvres ("earliest possible arrival time"). This estimation was based on historical arrivals and their median travel speed. In cases with port traffic restrictions, the earliest possible arrival time was adjusted forward taking into account the end time of the restriction window. The JIT potential was then calculated by noting the difference between the actual time when the berth became available and the earliest possible arrival time. Cases where the first visited berth was unoccupied at the earliest possible arrival time of the vessel were not included in the total JIT potential.

Figure 2 shows an example of this analysis process for one port

visit with significant estimated JIT potential. The blue line in the left-hand subfigure shows the speed over ground (SoG) of the vessel from AIS data, while the right-hand subfigure shows the corresponding vessel locations. As visible in the vessel's speed and position history, before entering the anchorage, the vessel manoeuvres in the vicinity of the port. In the left-hand subfigure, the vertical black line shows the time of entry to the idle area, the green line the estimated earliest possible arrival time at berth, and the purple line the time when the target berth became available. In this case, the estimated JIT potential was almost 95 hours.

RESULTS

Figure 3 shows the JIT potential in hours versus the time duration spent at anchorage for each vessel arrival in one studied port. The colours of the data points show whether there was a port traffic restriction during the arrival or not. On the high level, three types of arrivals can be identified in the data, as highlighted in the Figure.

In the first arrival type, the JIT potential is substantially larger than the observed anchorage duration. In these cases, the vessel has been manoeuvring or travelling very slowly within the idle area near the port. In the second arrival type, JIT potential is roughly the same as the observed anchorage duration. These vessels arrived directly at the anchorage area and then moved to berth as soon as it became available. Most of the arrivals are of this type. In the third arrival type, the JIT potential is lower than the observed anchorage duration. In these cases, for some reason, the vessels did not move to the target berth even though it had become available. Additional data on the vessel's operations would be required to analyse these cases in detail.



Example of positioning data and derived port call event times for one visit with significant JIT potential. Left: vessel speed over ground over time (blue dotted line), with detected events related to the port call indicated by vertical dashed lines. Right: vessel position data over the port call.

FIGURE 3.

Overview of waiting scenario types for one port. The vertical axis is the estimated JIT potential in hours, horizontal is the anchorage duration in hours. Each point in the figure is a single port visit, with the point colour indicating whether some port traffic restrictions coincided with the visit.





In total, the JIT potential was between 5,000 and 19,000 hours for the analysed ports, when assuming that traffic restrictions cannot be taken into account when scheduling vessel arrival times. It was found that if accurate information on port restrictions is available when planning port call schedules, the JIT potential is even greater.

Figure 4 shows the cumulative ratio of berth events having JIT potential versus the observed JIT potential amount in hours for three analysed ports (marked with green, blue, and red colour). For each port, there are two lines: the solid line is calculated with the assumption that there is information available regarding the end of the port traffic restriction time windows before the port call, while in the cases marked by dashed lines, this information is assumed not to be known in advance. It can be seen that the JIT potential varies significantly by port. For example, for the port with the highest overall JIT potential shown here, more than 35 per cent of the visits have more than 10 hours of JIT potential event without considering port traffic restrictions. This port has more restrictions than the other two ports, and the potential depends also on whether there is information available on the restrictions in advance.

DISCUSSION

The results show that the JIT potential can be estimated using AIS data and that there is substantial JIT potential in the analysed ports. The JIT potential of visiting vessels cannot be determined merely by exploring anchorage durations but it is also important to consider the approach and manoeuvring behaviour of the vessels. There are some limitations to this analysis: accurate estimations on the target berth availability and port restrictions are necessary to estimate the JIT potential of an incoming vessel. It should also be noted that ports differ from each other; idle area usage and behaviour of the incoming vessels may vary, and different restrictions may affect traffic. These factors need to be taken into account and the analysis must be adjusted according to the specific features of each port.

This type of analysis gives port authorities valuable information on how to enhance port operations and identify where the most significant gains can be achieved by adopting port optimisation tools. To implement JIT scheduling in practice, such optimisation tools need to include the berth planning processes of terminal operators in real time while enabling and monitoring the realisation of digital agreements between parties.

FIGURE 4.

Overview of IIT potential overall berth visits for three analysed ports, marked by green, blue, and red lines. Solid lines indicate the potential when port restrictions are assumed to be available in schedule planning, while dashed lines indicate the potential when this is not assumed, i.e. the waiting time due to port restrictions is removed from estimated IIT potential.

ABOUT THE AUTHORS:

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ABOUT THE COMPANY:

Awake.Al is a Finnish optimisation platform company whose solutions are focused on developing customised Al/ML models to optimise cargo flow through the ports and reduce waiting times and emissions. Awake's Al-driven Logistics Platform is developed to bring together all maritime actors at sea, ports and land, making port operations more efficient, safe and sustainable.

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awake.ai PORT vision

Port Call Planning and Optimization Solutions

Increase efficiency with Port Vision product and reduce CO2 emissions with power of Al

 Berth and Port Call Planning
 JIT Scheduling to Enhance Port Performance





Artificial Intelligence Solutions

Seamlessly integrate with your existing systems (API)

- Online Traffic Events Monitoring
- Vessel Voyage
 Predictions (ETA)

Smart Digital Ports of the Future 2024

DATA QUALITY AUTOMATION: THE KEY TO FUTURE-PROOFING THE MARITIME INDUSTRY

www.porttechnology.org



Kevin Martin, CEO, One Digital Nation

As we all gather in Rotterdam for the eighth edition of Smart Digital Ports of the Future, it is interesting to note the key topics for discussion this year—Digital Twins, IoT, Artificial Intelligence, and the role of digitalisation in achieving sustainability goals. Each of these topics highlights the technological ambitions of the maritime industry, but they are all underpinned by a single, unifying element: Data.

These technologies are not just passive users; they actively consume, transform and generate vast amounts of data. We're talking about millions of terabytes, often structured, sometimes semi-structured, but mostly unstructured. One would be forgiven for thinking that, given the critical role data plays in successful technology adoption, achieving goals, gaining a competitive edge, and even in day-to-day operations, good quality data would be a top priority for every organisation.

And yet, for many, it continues to be as elusive as it is essential—a challenge that demands urgent attention if we are to fully realise the potential of these emerging technologies. Why is that?

The complex nature of data is one answer, but there are more fundamental challenges. The cost of implementing and maintaining Data Quality Management systems; skills, processes, and resource requirements; data silos; integration challenges; the sheer volume of data—all of these combine



to complicate efforts to create a cohesive data strategy. Often, though, data initiatives are hindered by established organisational habits and a reluctance to change.

The picture isn't all bleak, though. The opportunities that mastery of data quality presents are substantial. Properly executed, data governance and Data Quality Management can be transformational. Among the many benefits, accurate data enables informed decisionmaking, enhances operational efficiency, and ensures regulatory compliance. The cultural shift required for good data management empowers organisations to be more innovative, proactively adapting to shifting market conditions. Wellmanaged data is more secure, can support sustainability objectives, and translates into measurable business outcomes.

The statistics speak for themselves. According to Forrester Consulting. 58 per cent of companies focussing on data are more likely to beat revenue goals than those that do not. BARC reports that businesses using data for decision making see, on average, a 10 per cent decrease in overall costs, with 69 per cent citing better strategic decisions, 54 per cent reporting improved control of operational processes, and 52 per cent reporting a better understanding of customers.

The stakes are high, but clearly, so are the rewards. Overcoming these challenges not only unlocks

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the opportunities of today but also sets the stage for the adoption of advanced and emerging technologies that can transform the industry.

But how can these obstacles be addressed?

Do you remember every piece of Smart Port literature you ever read, that cited automation as one of the key technologies of a Smart Port? Traditionalists may associate automation with yard equipment and cargo movements, but just as automation continues to revolutionise physical operations, it is also transforming digital processes, such as Data Quality Management.

For many, the barriers to entry into the world of good data quality are falling fast, most significantly the high costs of implementation and maintenance. Traditional approaches often in technology and highly skilled resources, putting them out of reach for smaller organisations or those operating lean teams. New methods democratise data management by leveraging advanced technologies to handle many of the more complex tasks that were traditionally handled by specialists. This makes the Data Quality Management role accessible to more employees,

simplified to a level where data management duties can be adopted alongside, or as part of, a more traditional role.

New systems are also designed to be user-friendly, adopting intuitive interfaces and automated workflows that reduce the dependency on technical expertise. By empowering employees with the tools to efficiently perform data quality tasks and by reducing the need for extensive training or specialised staff, Data Quality Management is now a more cost-effective exercise, even for organisations with limited budgets and resources.



Overcoming costs is a significant achievement. One would expect integration with legacy systems, such as those commonly found in ports and terminals, to be much more challenging. In fact, the task is far less daunting than it once was. Those legacy systems are typically built on similar proprietary database technologies, such as Oracle, SAP HANA and SQL-all of which offer standard connectors that facilitate easy integration with third-party applications. New tools break down data silos with multiple connections into discrete systems. Centralised data management, regardless of source, enhances overall data coherence, simplifies

the application of governance policies, facilitates data integration, and supports data consistency, setting businesses on the path to Master Data Management.

With integration challenges addressed, the next logical concern is how to manage the ever-increasing volume of data. After all, if people are good at one thing, it is hoarding vast amounts of data that is often duplicated, obsolete, redundant, or of no real value to the business. Once again, new tools rise to the challenge. It would take one employee 5,000 years to read one terabyte of data. Modern applications index it and turn it into a searchable resource in a matter of hours. Speed and accuracy are critical in the modern business environment, and timely access to reliable data is a crucial competitive advantage. Automated tools perform data quality tasks around the clock, giving organisations the comfort that data is accurate, up-to-date and ready for use in the decision-making process.

In many ways, the principles that ports and terminals have applied to improve the management, maintenance, and operation of their physical equipment translate seamlessly to the digital realm. Concepts such as asset management, preventive maintenance, automation, and standardisation—the bedrock of efficient and reliable terminal operations—are just as relevant to digital assets, including systems and data.

If Data Quality Management is the equivalent of Asset Management, then monitoring and cleansing represent preventive maintenance, and where automation of the physical yard equipment reduces manual labour and increases safety, Automated Data Quality Management also reduces effort, reduces errors, and improves the overall safety of the business from a security perspective by helping to control access to data assets.

With the exponential growth of global data expected to reach 463 zettabytes by 2030, the need to adopt robust Data Quality Management strategies has never been greater. The sheer volume of data-much of it unstructuredcreates a significant challenge that can't be addressed through traditional means and is only going to become greater. Moreover, increasing global regulation-such as GDPR and CCPA-makes data accuracy and compliance no longer a nice-to-have but a critical business necessity.

The cost of poor-quality data is staggering. Gartner, Inc., a global research and technology consulting firm specialising in



IT and supply chain functions, estimates it at \$15 million per year for large organisations. That doesn't only relate to financial losses, but also to lost opportunities, operational inefficiencies, and the erosion of trust that underpins decision-making. Put simply, the costs of poor data management are now too high to ignore.

If that isn't enough incentive, monetisation opportunities are beginning to emerge. Creators of large language models (LLMs) are reaching the limits of available data to train their systems on and considering the possibilities of synthetic data. Yet, the publicly available internet data they have been using until now represents less than half of the data in existence. These organisations, and others like them, are hungry for accurate, clean, and unique data in areas such as finance. healthcare, manufacturing, and logistics to train models for specific applications. The ability to capitalise on those opportunities could be a competitive advantage in an increasingly data-driven economy.

The adoption of data governance and the automated tools that support it is not just a tactical response to the challenges of modern business, but a strategic imperative that will define the future success of strategic digital, sustainability, and growth initiatives. It will in turn support the advanced technologies that will drive innovation in the industry.

Automated Data Quality Management empowers organisations with the tools to maintain data at scale, enabling them to proactively adapt to changing market and regulatory conditions. Incorporating Automated Data Quality Management into a data management strategy futureproofs the business, enabling it to leverage emerging technologies and drive long-term sustainable growth through enhanced decision making.

As organisations navigate the complexities of the digital age, their ability to manage data effectively will determine their success. In short, Automated Data Quality Management is not just the key that unlocks the full potential of organisational data, but a competitive edge that will position the organisation as a leader in tomorrow's data-driven economy.

ABOUT THE AUTHOR:

Kevin Martin is a visionary leader with extensive technology leadership experience in ports and supply chains. Kevin has diversified from pure-play consultancy, forming One Digital Nation to pioneer innovative solutions that empower organisations to harness the power of current and emerging digital technologies for strategic growth and operational excellence.

ABOUT THE COMPANY:

One Digital Nation is an independent technology partner with three decades of experience in the application of digital solutions in commercial environments, including ports, terminals, supply chains, utilities and smart cities. They work with technology partners to provide proven, practical, digital solutions that deliver tangible results.

The company also provides a range of business consulting and technology outsourcing services to support ports and terminals with IT Strategy, Business Process Analysis and Design, Process Automation, IT Programme and Project Delivery, Software Development Lifecycle, Data Quality Management and Business Change.

"THE ABILITY TO CAPITALISE ON THOSE OPPORTUNITIES COULD BE A COMPETITIVE ADVANTAGE IN AN INCREASINGLY DATA-DRIVEN ECONOMY."